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COUNTRY REPORTS

International Cartographic Association: progress during 1991-1997

Paper submitted by the International Cartographic Association**

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INTRODUCTION

The International Cartographic Association, the world body for cartography, has been in existence for almost 38 years and its broad aims are: to contribute to the understanding and solution of world-wide problems through the use of cartography in decision-making processes; to foster the international dissemination of environmental, economic, social and spatial information through mapping; to provide a global forum for discussion of the role and status of cartography; to facilitate the transfer of new cartographic technology and knowledge between nations, especially to the developing nations; to carry out or to promote multi-national cartographic research in order to solve scientific and applied problems; to enhance cartographic education in the broadest sense through publications, seminars and conferences; to promote the use of professional and technical standards in cartography. Since its foundation in 1959 the list of member nations has grown from 13 to over 80 with more than 12 affiliate organisations. Its main scientific work is done by Commissions and Working Groups. In 1995 these sections, comprising 250 individuals drawn from 66 countries, were active in 16 subject fields which are described below. Some changes took place at the ICA General Assembly in 1995 and now only 15 sections are operational including new commissions on Visualization, Marine Cartography, and Gender and Cartography. There are 2 new Working Groups, namely Children and Cartography and Map Generalization. In addition to accounts in the ICA Newsletter, their accomplishments are typically recorded through limited circulation reports and proceedings. There is also an established and expanding publication programme under the Pergamon/Elsevier banner. Active links of many kinds with a range of leading international organisations, such as the United Nations, have helped raise the profile and extend the reach and influence of the ICA across the world.

A special relationship has been established with UNICEF following the untimely death of vice-president Barbara Petchenik, in 1992. The Children's Map Design Competition, an award set up in her memory, has been helping to unite the ICA world in a new and exciting way and the importance of this award has also been recognised as a salute to the United Nations in its 50th Anniversary Year.

The ICA faces major challenges as we approach the next millennium, but as environmental and societal problems increase in magnitude and complexity so have the power and potential of digital maps to contribute to their solution. Ideas based on new technology (e.g. GIS) and increasing knowledge of how maps are perceived, used and understood, are being co-ordinated by workers within the ICA to help tackle world-wide problems. The meetings and output of ICA workers have been publicised in various ways over the years, and in 1994, the Executive Committee decided to raise awareness of these activities. A booklet entitled "*The Achievements of the ICA, 1991-95*" was compiled to help inform both the membership and, where possible, the wider community.

ROOTS AND VISIONS - past, present and future

The ICA pays special attention to fundamentals, including history, map use and the theoretical basis of the subject. Recent activities of the Standing Commission on the History of Cartography have focused on the publication of an international bibliography of map makers and map producing firms. Collected on a national basis the International bibliographic Guide (How to Identify a Mapmaker) provides a fascinating and valuable resource for researchers and collectors alike, adding to the Commission's previously acclaimed work on the Teaching of the History of Cartography. A successful seminar took place in Chicago (1993) co-organised with the Commission on Education and Training.

The actual employment of maps has been the focus of the Commission on Map and Spatial Data Use (now simply 'Map Use') in which initial challenges included identification and examination of the characteristics of map use. A matrix of map-and-spatial-data-use typology is being developed with an accompanying bibliography keyed to the various 'use' dimensions. Related but important aspects of this commission's activities have been the organisational or supportive contributions made at major national and international meetings, including the Joint-Commission Seminar on Electronic Atlases, Visegrad, Hungary, 1993; a Technical Session on Electronic Atlases, at the American Congress on Surveying and Mapping Conference, USA, 1994; a Session on Map Use, at the Association of American Geographers Conference, USA, 1995; and the ICA Joint-Commission Seminar on Animation in Cartographic Education, in Spain, 1995 and Japan 1996. Perhaps one of the most significant legacies of this Commission has been its part in the development of the new concept of Cartographic Visualization: these ideas surfaced at a special meeting held at the International Cartographic Conference in Cologne, 1993, which stimulated the important ICA publication, '*Visualization in Modern Cartography*'. This success led to the establishment of a separate Commission to take the subject forward into the next session. More recent work has extended to the use of maps on the Internet. The new Commission on Visualization has been one of the most active and energetic of the post-1995 session. Seminars have been held (e.g. Netherlands, 1996) and most significantly a new project in collaboration with ACM-SIGGRAPH in the USA is exploring how viewpoints and techniques from the computer graphics community can be effectively applied to cartographic and spatial data sets.

The Working Group to Define the Main Theoretical Issues on Cartography selected five guiding topics on which their studies would be based, namely map function, spatial processes, social context, processing digital data, and map language. These were offered in outline to the ICA Newsletter in 1992 and the final report, "*The Selected Main Theoretical Issues Facing Cartography*" was presented at the ICA Conference in Cologne, 1993. The Group's more recent activities have included publication of the report and questionnaire in *Cartographica 30(4)*, 1993, and in the *Journal of the Japanese Cartographer's Association*, with a summary appearing in other selected journals and also distribution of the questionnaire to many countries. The work of this group, reported in a special session at the Barcelona Conference (1995), has also led to the establishment of a full Commission for the period 1995-99. Since 1995 new sub-groups have been established to investigate cognition, map semiotics and definitions and a successful joint seminar took place in Gifu, Japan, in November 1996.

SPATIAL DATA - quality, transfer and marketing

Data quality has always been of importance in mapping science but in the past it was generally a characteristic of the basic hardcopy map itself. Today, the concept of a 'map' has broadened to include what are now known as virtual maps, ranging from ephemeral screen displays to spatial databases themselves. In a future which will depend increasingly on the deep structure of spatial data the digital database will become the bearer of quality, placing great responsibilities on those who must establish, maintain, transfer and, indeed, market data, especially at a time when such data is increasing in quantity and level of usage. The Commission on Spatial Data Quality has been examining these issues in the belief that the quality of spatial data

- is very important as large databases are created for access, exchange, and use by many individuals;
- should be assessed and reported as part of each spatial data file of information;
- should be made known to the consumer of any analysis using spatial data.

This small but active group has been exploring the basic elements of their chosen theme to provide cartographers with comprehensive definitions of those elements. Seven have been agreed, namely Lineage, Positional Accuracy, Attribute Accuracy, Completeness, Logical Consistency, Semantic Accuracy, and Temporal Accuracy, and its main accomplishment has been the publication of an Elsevier book, in October 1995, containing the required definitions. Since then the ISO Technical Committee 211 on Geographic Information/Geomatics has accepted six of the seven elements. This provides a sound basis for further research into the display of data quality and reliability which will be made in conjunction with those studying Cartographic Visualization.

The Commission on Standards for the Transfer of Spatial Data has an equally important and perhaps more urgent brief. It was first necessary to examine information from ICA member nations and from other relevant bodies, on the development of such standards. Study of the published standards of ICA member countries has also been important in these preliminary investigations. Assessment characteristics of transfer standards have been developed, refined and tested and technical presentations made at the ICA International Conference in Cologne, 1993. The first main achievement was an ICA Report (June, 1994) entitled "*Technical Characteristics for Assessing Standards for the Transfer of Spatial Data and Brief International Descriptions*" in which the standards from twenty-three countries are described. A significant by-product of this ICA work has been a request that the Commission serve as an International Standards Organisation (ISO) category A Scientific Liaison to ISO TC211 Technical Committee on Geographic Information/Geomatics. Since Barcelona 1995 the edition "*Spatial Data Transfer Standards 2*" has been published along with a report on *"Technical Characteristics for Assessing Standards for the Transfer of Spatial Data and Brief International Description"*. Currently intense work is going on to define a set of characteristics for assessing special metadata standards.

As spatial data is now a tradable commodity within national and international economies, during the 1991-95 session, the Working Group on Marketing Geographic Information investigated perceived barriers to the marketing process. A draft charter on the topic entitled 'Common Responses to Common Challenges' was prepared which recognises the need for both a balanced approach to the subject and a response to the growth of private sector capacity to develop Geographical Information. It is designed to meet the needs of Cartographic Organisations, private and public, and adopts a terminology synchronous with the language of

the private sector. In particular the charter sets out a series of guidelines under the headings, Data Quality and Integration, Copyright, Royalties and Licensing, and Rights and Responsibilities. The subject is far from simple but over time a set of guidelines such as these will allow common responses to many if not all of the common challenges being faced.

MAP COMPILATION & PRODUCTION - continuing challenges and opportunities

The methods of map production have been in a state of transition over recent years as have the nature and sources of the information contained in maps. The ICA's responsibility covers a spectrum of international practice which includes promotion of the best of traditional (analogue) methods while facing the challenges presented by new digital technology. Such concerns have overarching characteristics and are difficult to compartmentalise but three Commissions have been examining core factors within the subject area.

Remote Sensing has contributed much to the advancement of mapping science and this field has been the focus of the ICA Commission on Thematic Mapping from Satellite Data. The expanding manufacture of tools for image processing, the increasing adoption of GIS and also the multiplication and diversification of civilian space programmes for ground observation are key elements in this revolution. Only a fraction of the available imagery is currently being utilised but changes through technology are due during the next five years. Progress in the use of satellite imagery in GIS highlights the need to distinguish between aspects relating to data and to information for the different dimensions of the cartographic message (geometric and semantic). Perhaps the Commission's three most outstanding achievements during 1991-96, reflecting the above ideas, have been:

- "*La télédétection aux fins de la cartographie topographique et thématique*", their ICA contribution to the Fifth United Nations Cartographic Conference for the Americas.
- "*Guide Book for Thematic Mapping from Satellite Imagery*", a major work of reference.
- The international symposium "Des images satellites pour la cartographie et les systèmes d'information géographique", organised in Tunis with the support of CNT (Centre National de Télédétection) in 1993. The proceedings were published as *Bulletin No.142-143 of the Comité Français de Cartographie* (1995).

One of the greatest challenges to digital cartographers, that of automating the map generalisation process, was taken up on behalf of the ICA by a section within the Standing Commission on Advanced Technology. The first important achievement of this working sub-group on Map Generalisation was the establishment of active links between experts and organisations from many countries. More formal involvement has occurred:

- Specialist Meeting of the NCGIA Initiative 8 "Formalizing Cartographic Knowledge", USA 1993.
- ESF GISDATA Symposium on Generalization, France 1993.

However, in contrast with most of these organisations, the ICA takes a more international approach and pursues a longer term strategy. A pre-conference Workshop was organised on Progress in Automated Generalization of Spatial Data (1-3 September 1995), in addition to regular events at ICA conferences in 1993 and 1995 and other meetings in 1996. A Special Map-Generalization Issue of Cartography and Geographic Information Systems and a report on the Workshop on Progress in Automated Map Generalization was published as an NCGIA Technical Report were both published in 1996.

The origins of the Standing Commission on Map Production Technology lie in analogue mapping, as characterised in its textbook "*Compendium of Cartographic Techniques*" (1988). Although digital techniques are displacing many of the traditional there is still sufficient market to warrant a second edition of this text. However it will be in two volumes, with the second devoted to digital techniques. The revised manuscript of Volume I, with new chapters on colour systems and special cartographic products, is near completion. Work on Volume II is now under way. Another important project, an overview of technologies used for map production and reproduction world-wide, is also in hand. The third achievement of this session has been the preparation and agreement on a standard symbolisation for both analogue and digital production flow diagrams. The scheme has been discussed widely and has already been introduced by some ICA member countries into their own operations. Details are included in Volume I of the new edition of the Compendium text. As this Commission is concerned with practical matters, workshops on map production took place in Zurich, Switzerland, 1992; Cologne, Germany, 1993, and Prague, Czech Republic, 1994. However, perhaps one of the most memorable events of this session was the collaborative Seminar with the Standing Commission on Education and Training and the Working Group on Gender and Cartography, on "Teaching Map Production Lines and Digital Cartography", Istanbul, Turkey, 1994. More recently further work has taken place, including an ICA Seminar in Santiago, Chile (August, 1996) and a Workshop in Indonesia in March 1997

MAPS ARE CHANGING - design and innovation

Although paper maps are unlikely to disappear completely from the cartographic scene in the near future, 'new' maps are already taking over in many important map using and decision-making situations. Animated and interactive virtual maps with additional undreamed-of dimensions are currently in use or under development, and the ICA is playing its part.

Two sub-groups of the Standing Commission on Advanced Technology have been involved in these developments. The first, Multimedia Applications for Cartography, represents one of the most exciting areas of advancement into the cartography of tomorrow. Research is under way but future plans will focus more sharply on specific projects to accelerate expansion of the field within the ICA. The second, Time in Cartography, has focused its research activities on the organisation of sessions linked to various international conferences, notably GIS/LIS '92, San Jose, USA, 1992; 16th ICC, Cologne, Germany, 1993; GIS/LIS '93, Minneapolis, USA, 1993; Spatial Data Handling Conference, Edinburgh, Scotland, 1994.

A two-day pre-conference event took place in Delft, Netherlands, just before the Conference in Cologne in 1993, and a similar joint three-day session before the start of the ICA General Assembly in Barcelona in September 1995. The latter benefited from interaction with the Standing Commission on Education and Training, the Commission on Map and Spatial Data Use and the sub-group on Multimedia Applications. The Time group's special contribution here was "Temporal aspects in animated cartography".

Protection and improvement of the environment is one of today's major tasks. Environmental monitoring requires a global sampling framework the changing data from which must be displayed and analysed on maps of various kinds, many of them innovative in character. One recent example of ICA involvement in such work was the international conference organised by the Commission on Advanced Technology in Warszawa, Poland, 1994. This meeting, entitled 'GIS in Ecological Studies and Environmental Management' was also sponsored by the United Nations.

The national atlas genre, still less than a century old, has undergone many changes in content and structure. In recent years it has been one of the test-beds for the application of new technologies such as multimedia. During the current ICA session the Commission on National and Regional Atlases has included such advances in its work plan and the main part of the first seminar (Madrid, 1992) was devoted to electronic atlases. A decision of that meeting was to investigate the current production, costs and marketing of national and regional atlases in member countries, and the results were reported to the ICA International Conference in Cologne (1993). 1993 was also the year of a seminar focused on the production, teaching and use of electronic atlases: the published proceedings of that meeting have proved to be of tremendous value as a source on the subject.

The promotion of regional electronic atlases in North America was discussed in a special session at the 1994 ACSM/ASPRS Annual Conference in Reno, Nevada. A new kind of electronic atlas, involving CDs and thematic datasets on the Internet, was discussed but could only become possible through standardisation and national strategies allowing access to the appropriate data. The proceedings are widely available in a special issue of *Cartographic Perspectives* (Winter, 1995). In 1996, at the invitation of the IGU, the Commission organised an excellent symposium on Electronic Atlases in the Hague and current work progresses on a prectical guide for organizing and creating electronic atlases

INTERNATIONAL OUTREACH - education, equality and special needs

Although every Commission and Working Group is involved in outreach, through distant networking and the organisation of meetings world-wide, some have special missions with broader appeals.

The theme of the Standing Commission on Education and Training might be described as spreading knowledge of and respect for, cartography in all its manifestations through the process of teaching. One of its most widely appreciated contributions has been as an initiator and an integrator of its educational activities with those of other ICA Commissions and Working Groups. The seminars can be classified as follows:

- for cartographers from developing countries: "Teaching Map Production Lines and Digital Cartography", Istanbul, 1994 (the first international cartographic event in that region of the World) ; "Digital Cartography and GIS", Bangkok, 1994 (an achievement in its local impact as well as the diversity and dedication of the international teaching team);
- "New frontier" seminars for gathering new material for "*Basic Cartography*" texts: "Surveying and Mapping Aspects of Visualization and GIS", Washington, 1992; "Electronic Atlases", Visegrad, 1994; "Animated Cartography", Madrid, 1995.

More recent meetings have been held in Chile (August 1996), Japan (November 1996), Russia (January 1997) and Indonesia (March 1997). Proceedings are available of the meetings in Budapest (1991), Uppsala (1992), Washington (1992), Visegrad (1993), Chicago (1993), Istanbul (1994), Bangkok (1994) and Vienna (1995). One of the most important on-going achievements of this Commission has been the textbook series "*Basic Cartography*". The Second Edition of Volume I was revised and published in 1993 and Volume III has been published in 1996.

Through its energetic and constructive outreach programme this Commission is one of the leading promoters and publicists of the ICA throughout the World.

Continuing the global theme the goal of the Working Group (now a Commission) on Gender and Cartography is to promote equality of opportunity in all organisational units and at all levels of responsibility within the ICA and its member countries. Specifically this includes the present status of women and other under-represented groups such as younger cartographers or cartographers from developing countries. Other plans are to achieve more balanced contributions by gender, age group and geographical region and to study the impact of technological change and societal development on the cartographic profession. A number of significant achievements reflect the success of the group during 1991-95:

- Digital database of the circumstances and opinions of over 600 women in cartography, survey and GIS from 42 member countries.
- Directory of Women in Cartography, Surveying and GIS, published 1993 (2nd Ed.1995). This contains data on 300 women from over 40 member countries and has already been used by the organising committees of the Cologne (1993) and Barcelona (1995) conferences, raising significantly, the participation of women in both.
- Organisation of training seminars given by women members of the group in Mexico, 1992 and as part of the ICA Seminar in Istanbul, 1994. Subjects presented included 'GIS and Expert Systems in Cartography' and 'Visualization, Hypermedia and Multimedia applications in Electronic Mapping'.
- Two Workshops on gender-related issues entitled 'The Role of Women in Technological Change' at the ICA Conference in Cologne, 1993.
- Contact with the IGU Commission on Gender and Geography and an invited paper given to the IGU Conference, 1992. The IGU Commission was so interested in the work in the ICA group that they set up a Permanent liaison between them.
- International recognition of the role of the Working Group was made through two invitations received from the UN to present papers at the 5th UN Cartographic Conference for the Americas, New York, 1993, and the 13th UN Regional Cartographic Conference for Asia and the Pacific, Beijing, 1994. An important resolution, proposed in that paper and passed by the Conference, stated: "The Conference, acknowledging the important role women play in surveying, mapping and charting, and noting the under-representation of women at professional, educational conference and networking activities, recommends that the national survey, mapping and charting organisations create increased opportunities for women to attend such activities and create opportunities or women for career advancement".

This section has contributed significantly by increasing professional development opportunities for the target groups. A new edition of the Directory of Women in Cartography is under way and further seminars and workshops are in hand.

Another active group with specific outreach in South America is the Commission on Tactile Mapping and Low-vision Mapping (re-named Maps and Graphics for Blind and Visually-impaired People). To its general work in this field have been added closer links with the Committee on Access to Information and Culture of the World Blind Union to increase world-wide co-operation. Apart from Commission meetings held in Brazil and Cologne the most important achievement was the IVth International Symposium on Maps and Graphics for the Visually Impaired (Sao Paulo, Brazil, 1994) which proved to be a major breakthrough in establishing contacts and building enthusiasm throughout Latin America. Two workshops were organised in early 1995 (in Argentina and Northern Brazil) and more are proposed for Chile and Peru. The proceedings of this

symposium are in course of publication and plans are being laid on the format for an atlas for children with a teachers' guide.

SPECIAL THEMES

Special themes pervade all the work of the ICA but this section focuses on two which are subject specific.

The Working Group (now raised to a Commission) on Marine Cartography is a large and enthusiastic assembly mainly of networked corresponding members. Although correspondence is the primary means of communication, five meetings have been held in Baltimore, Cologne, Norfolk VA, Monaco and Cork. Liaison has been established with the International Hydrographic Organisation, The Hydrographic Society and the IGU and maximum encouragement, through expert contacts and assistance with sources, is given to authors writing in the field. Promotion of the ICA and cartography as major contributors in the field of coastal zone management has been achieved in a number of ways:

- Preparation of a comprehensive review of the status of marine cartography.
- In co-operation with the IGU Commission on Coastal Systems, introduction of a successful series of CoastGIS Symposia (e.g. in Norfolk, USA 1994 ; Cork, Ireland 1995) establishing the ICA as a leader in the field.
- Promotion of the coastal zone as an entity in the drive for digital data standards.

A multi-lingual gazetteer of ocean names is on the agenda and papers have been authored by group members in the area of coastal zone cartography and data availability. The proceedings of the series of Conferences held since 1990 are in the process of publication.

The Commission on Cartography of Population Mobility, formed in 1991, has operated almost solely as a compact traditional-mail-networked group. Although within the theme of population mobility, the special problems selected for attention were the definitions of, and some suggested solutions to, mapping the size and location of international (transfrontier) and interregional (within country) population migration. Some of these have been explored but the objectives were later narrowed to examples only, selected from a wide range of mobility issues - local/regional to global, migration and refugee problems. A variety of population parameters were investigated, from country totals to data on tourist movements between countries. Results of research were presented at the Barcelona Conference in 1995. Perhaps unique to this report, the achievements of this Commission have included the compilation and production of coloured maps including the 1992, 1993 and 1994 editions of the map of world-wide distribution of humanitarian aid provided by the ECHO Programme (European Community Humanitarian Office, Brussels) and various other maps of refugees and displaced persons.

MAPS, CHILDREN and the WORLD

Barbara Petchenik, Vice-President of the ICA, who died in 1992, had a lifelong interest in maps for children. For this reason it was decided that a most appropriate memorial would be an Award for world maps created by children. The competition is open to children under 16 years of age who are invited to draw a map of the world on any theme of interest to them. Negotiations with UNICEF added value to the award. Winning entries would be accepted for consideration as designs for their famous Greetings Card range. Each member nation of ICA is asked to organise the competition and to select a maximum of five drawings according to its own criteria. The

national winners are then forwarded to ICA and following display at an ICA conference, ten international winners are selected with at least one from each continent. 27 member nations participated in the first competition in 1993. Judging was difficult with the variety of artistic creations presented, and themes ranged from the traditional (peace and the environment) to individual impressions of the horrors of hunger, war, famine and pollution.

This initial UNICEF connection led to the incorporation of many of the children's maps into a United Nations CD-ROM called *My City*, which was in the exhibit at the world Summit on Social Development in Copenhagen in 1995 and subsequently travelled to New York and to the Women's Summit in Beijing in September 1995. *My City* is an interactive educational game for schools and children, which is based on the Convention of the Rights of the Child dealing with issues of culture, law, welfare, education, health and environment. The producer of the CD viewed all seventy finalist maps from the 1993 competition and incorporated over 20 of them into My City. *My City* is being distributed to schools in North America and Europe in August 1995 and the producers have indicated a desire to include maps from subsequent competitions into their products.

The maps have also attracted further interest. UNICEF Canada, as part of the lead agency for the United Nations Convention on the Rights of the Child, and the ICA propose to develop an educational tool from the 1995 children's map competition in the form of a large colour wallsheet. Selected children's maps will represent their views of the world and the wallsheet will be used as a vehicle for children to express their concerns about pressing development issues and present alternative ways of looking at the world. Although initially Canada-based, the intention is to extend this project to all UNICEF nations.

The ongoing efforts of the ICA to encourage the creation of maps by children may be the most significant achievement of the Association to date. Thousands of children have been involved and maps which have been neglected in the formal educational system of many nations are being re-introduced as a means of understanding, analysing and experiencing the most important international issues facing the world today. In recognition of this theme a new ICA Working Group on Cartography and Children was established in 1995. Their first activity has been their part in the seminar on Cognitive Map, Children and Education in Cartography, held in Gifu, Japan (November 1996). The proceedings of this seminar are now in print.

Conclusion

The achievements presented here are important for a number of reasons. They are evidence of the energy and expertise of many people both leading and participating in the groups described. They should be of interest to cartographers in general as ICA people are mainly cartographers who have chosen to become involved in the wider mission of an international organisation. They only represent a stage in the continuing evolution of the ICA. Most Commissions continue their work from one 4-year session to the next, but new Commissions emerge, normally after a period as a Working Group. The next session is thus enriched by the presence of new Commissions on Theoretical Fields in Cartography, Visualization, Marine Cartography, and Gender and Cartography, and also embryo Commissions, in the form of new Working Groups on Map Generalisation, and Cartography and Children. Further suggestions for Working Groups are also on the agenda for the near future including Planetary Cartography. There has been a tendency for grass-roots cartographers who are not directly involved in ICA activities to regard the

organisation as 'remote' and even irrelevant to their everyday working lives. This is understandable as leading participants have frequently been senior staff and involvement can cost money for travel, etc. It is the author's wish that this feeling should fade and be replaced by one of awareness of being part of a world-wide 'family' with common aims and wishes. After all if you belong to one of the ICA's member nations then you are already a member of the organisation and could participate! Corresponding membership of Commissions and Working Groups need not involve the costs of travel but can allow members to share their ideas and truly participate in discussion and decision-making. This kind of participation is even more rewarding today with electronic mail and the Internet which can make you feel closer to the heart of things. Indeed, growth of Internet use and Home Pages for the ICA and many of its Commissions and Working Groups have been features of the current session. Travel itself is rewarding but it is also good just to 'talk' to colleagues across the world. If you have useful opinions about the ICA and its activities or would like to become more closely involved please communicate with your national delegate/contact person (through the Secretary-General if necessary) or with the President. The greater the involvement by the wider 'mapping' scientific community the greater the strength of the ICA.

OFFICIAL PUBLICATIONS of the International Cartographic Association, period 1991-95

Inventory of World Topographic Mapping, Volumes 2 and 3. Compiled by Rolf Böhme, English Language Editor Roger Anson, 1991 and 1993

Basic Cartography for students and technicians, Volume 1 (Second Edition). Edited by R.W. Anson, 1993

Basic Cartography for students and technicians, Volume 3, Editors R.W. Anson and F.J. Ormeling, 1996

Thematic Mapping from Satellite Imagery, a Guidebook. Edited by J Denègre, 1994

Elements of Spatial Data Quality. Editors S.C. Guptill and J.L. Morrison, 1995

Abstract

The International Cartographic Association is a non-governmental organization. This world body for cartography has been in existence for almost 38 years. It has now over 80 member nations. Its main scientific work is done by commissions and working groups having about 250 individuals from more than 60 countries. Here are some results.

- The commission on Spatial Data Quality has defined seven quality elements for assessing spatial data sets. Its valuable contribution has been published in 1995 as *Elements of Spatial Data Quality*.
- The commission on Standards for the Transfer of Spatial Data has produced a report *Technical Characteristics for Assessing Standards for the Transfer of Spatial Data and Brief International Descriptions* in 1994 and is scientific liaison to the ISO Technical Committee on Geographic Information / Geomatics, TC 211.
- The commission on Thematic Mapping from Satellite Imagery has published a *Guidebook for Thematic Mapping from Satellite Imagery* and has organized an international symposium 'Satellite Imagery for Cartography and Geographic Information Systems' in Tunis in 1993.

- The commission on Education and Training spreads knowledge of cartography through teaching. It has organized seminars including two seminars in 1994 for cartographers from developing countries in Istanbul and in Bangkok.
- The goal of the working group on Gender and Cartography is to promote equality of opportunities in all organisational units and at all levels of responsibility within the ICA.
- The commission on Tactile Mapping and Low-Vision Mapping has worked closely with the World Blind Union. It has participated in the IVth International Symposium on Maps and Graphics for the Visually Impaired in Sao Paulo, 1994 which has built enthousiasm throughout Latin America on this issue.
- The working group on Marine Cartography has established liaison with the International Hydrographic Organization and the International Geographical Union. One result is the IGU-ICA series of CoastGIS symposia.

Through its Barbara Petchenik Children Maps Awards, the ICA has a chance to encourage the creation of maps by children. Every two years an international contest is opened with the active support of ICA member nations, and up to ten children receive an ICA Award. Thousands of children have been involved in the 1993 and 1995 contests, and maps which have been neglected in the formal educational system of many nations are being re-introduced as a means of understanding, analysing and experiencing the most important issues facing the world today.

Most commissions now continue their work and new ones have recently emerged : theoretical fields and definitions in cartography, visualization, map generalization, and cartography and children. If you have useful opinions about the ICA and its activities or would like to become more closely involved, please communicate with ICA Secretary General.

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Item 5 (a) of the provisional agenda*

REVIEW OF THE LATEST TECHNOLOGY IN CARTOGRAPHIC DATA ACQUISITION, MANIPULATION, STORAGE AND PRESENTATION, WITH SPECIAL EMPHASIS ON POTENTIAL APPLICATIONS IN DEVELOPING COUNTRIES: AUTOMATED MAPPING PROJECTS: DEVELOPMENT AND APPLICATION OF DIGITAL CARTOGRAPHIC DATABASES, INCLUDING DIGITAL TERRAIN MODELLING

Maps and mapping: the ICA vision of the future

Paper submitted by the Secretariat**

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Introduction

Maps pre-date scientific measurement but cartography has continued to adapt to changes in concept and technology. Following a restatement of the unique character and vital importance to spatial science of maps and (their designers), this paper reviews how technological changes are challenging cartographic theorists in the fields of both production and use. Current trends and future possibilities are noted and the inevitability of a longer-term convergence between the component spatial sciences is foreseen. The increasing institutionalisation of commonly employed technologies such as Global Positioning System (GPS) and Geographic Information System (GIS), and a greater focus by the whole spatial science community on seeking solutions to world-wide problems should encourage the growth of teamwork rather than isolated scientific activity to confront these challenges.

Background

There should be no need to justify the vital part played by cartography within the geospatial sciences. But in this increasingly complex and technology-led world such obvious and fundamental truths can easily be taken so much for granted to render them invisible ! Also cartography is changing and not everyone seems fully aware that maps are no longer merely the end points of a data manipulation/assembly process - manual or digital.

The International Cartographic Association (ICA) is founded on one of the most natural human creative processes, that of mapping, and traditionally the creation of 2D graphic images of mapped information. Maps and mapping have pervaded history and prehistory, the Arts and the Sciences, and cartographers have been regarded as the compilers and ultimate creators of those unique, versatile and valued graphic images. A classic well-designed topographic map, for instance, offers (within the sheet lines) a most sophisticated graphic summary of a region. Symbols and names may be densely packed but are still intelligible, and the design allows for both wide and more focused views. The content has been generalised to be true to scale and thus the map has overall integrity. Such an image offers scope for all types of reading, from rapid overall scanning down to selective focus on the smallest regions or symbols. This makes effective use of both foveal and peripheral vision and over the centuries we have become very sophisticated in the way we read and otherwise use such paper documents. Maps of this type have played (and continue to play) a significant role in the transformation and expansion of our knowledge and understanding of the world. Cartographers, with their craft, may have partly controlled the subject in the past. As with other experts their knowledge and skills are largely intuitive. People accept that good maps are produced by expert cartographers (hopefully with quality data). However, over the past half-century in particular, scientific enquiry has tried to look beyond the craft and the artefact into the more fundamental processes of spatial modelling, map creation and use. The study of map use strategies naturally embrace psychology, including human information processing, and today there is a greater appreciation of the relationships between the nature of a task and the requirements of the circumstance and the user. Together

these can inform and support the way maps are employed, be it in a data manipulation and management tool such as GIS, or in a graphic software package offering more sophisticated product design.

New technology, from the drawing aids of the mid-twentieth century to computers and beyond, has progressively removed the yoke and obvious limitations of manual production. Now the whole mapping process has become much more dynamic, flexible, multi-dimensional and interactive. The wonders of multimedia have also added new depth and excitement to computer maps, providing opportunities for both science and the general public. Visionary cartographers in the past had, of course, already experimented with many similar or related ideas but only now can technology help remove the frustrations of their dreams. Visualisation in scientific computing (ViSC), a technology-supported facility which is raising the effectiveness of research especially into large datasets across the sciences and engineering, and which has accelerated in scope and power over the past decade, shares its roots (and much of its terminology) with cartography. The interactive scope and versatility of both ViSC and the emerging (and related) Geographic Visualisation systems (GVIS) - especially when they incorporate high quality data and innovative design - can be interpreted as natural extensions of human mental visualisation which is, in itself, one of the most powerful facilities for qualitative exploration and analysis. Just as ViSC has, within a decade, added exciting new visually intuitive routes for research in science, engineering and manufacture, so it can be observed that the scope and potential of modern cartography - for both data exploration and representation - are on a rising curve toward new status and scientific respectability. However, all these radical changes in the field of mapping may have led many users (especially new users not previously involved with maps in their business) to disengage the term 'cartography' from what is happening today. There are countries where the mapping culture has been in decline within the general population, but when the situation is transformed and the GIS vendors arrive, many truly think that 'GIS' is the new term for cartography! Cartography is one of the most important tools of science and management. Although now digital in nature, much of its power lies in its visual characteristics, and there is a danger that the 'visible' side of cartography is being taken for granted as more and more people embrace the subject as an integral part of their own fields. Indeed the new term 'Geomatics' could well be described as an abbreviation of a more clumsy but more honest term, 'Geo(visio)matics', the essential visual core having been rendered invisible! The power of cartography has always existed but restricted in the past by technology. Today, with precise data - available almost universally on the Internet, huge data manipulation possibilities (integration, analysis), virtual (screen) output as well as the world of hypermedia, this power is certainly now fully established. After decades of developing technology it is now reaching effective maturity.

But, has this new technological age of apparently limitless mapping power arrived too soon? At present workers in certain branches of our field may be striving to make accessible large quantities of high quality data which does not suffer in the process of transfer. This (and other much poorer) spatially-related data is being accessed with increasing energy and enthusiasm by a wide and growing range of users. Also most GIS users appear to be applying their systems, directly or indirectly, largely towards the production of maps (or at least map-like images) and professionals and others are being confronted with more maps than ever before. In addition, increasing numbers of people have access to so-called user-friendly map-making tools, but they lack an understanding of the principles of cartography. A word-processing package alone does not transform a user into a leading author. It merely facilitates the manipulation and storage of

words. Unfortunately new data sources and visualisation systems may have arrived before we know how even the more traditional static map images are used. Research into such vital cartographic topics is essential to help theory keep pace with practice, and the ICA is providing the international framework within which such work can progress.

Mapping - for the new millennium

Although progress will vary from country to country, by the year 2000 the technology-influenced trends of the 1980s and 1990s will have spread more widely across the developed and the developing world.

Computers. Lower cost/higher power computing will help accelerate the transition from manual to digital map production - although there will continue to be a demand for topographic and thematic map series as well as customised map creation by professional cartographic practitioners.

Effects of advances in other related fields. These will continue to have an impact on various stages of the mapping process -

- Sources : GPS, GIS, image processing, large spatial databases.
- Design scope : computer graphics.
- User support : artificial intelligence/expert systems, virtual reality

Widening base of non-cartographically expert map creators. Professionals in many fields, as well as the general public, will, increasingly be offered low-cost map-related software. Like the diffusion of word-processors and database packages, these will also become more accessible through, e.g.

- GIS and mapping modules incorporated into word processors, spreadsheets and database software.
- Navigation aids of many kinds, personal and vehicle guidance.
- User-friendly interfaces incorporating enhanced intelligence advisory (help) facilities. Like Microsoft's 'wizards', these will guide users towards structured approaches to map generation and will also be available in more context-sensitive modes to aid compilation and design operations.
- Huge expansion of low-cost electronic atlases of all kinds (CD-ROM, networked).

Enhanced spatial analytical facilities for professionals. GIS with more advanced statistical packages, etc., will facilitate the creation of analytical maps. This will encourage greater application of geo-spatial thinking within real-life problem solving and as an aid to decision-making.

Growing awareness of the new data sources and mapping technologies will lead to expansion and new focus of cartographic theory. There will have to be more understanding of the cognitive aspects of information transfer as technical and philosophical problems are solved.

Widening facility for interaction by users with software and data sources. Packages may be customised to meet particular user-working-strategies and needs so that systems can appear more intuitive and offer more rapid responses to queries for data or routes to the cartographic approaches to problems.

Geographic (scientific) visualisation. This new way of defining map use in exploratory research will lead to a renaissance in cartography. Innovative processes, packages and ideas will be accompanied by developments in map use theory.

Mapping - 25 years on

Apart from the strengthening of today's trends mentioned above other characteristics will emerge:

- World-wide networks with related infrastructures will have been established. This will offer what might be called 'distance mapping'. Across the Internet will come real data
  - geospatial databases with true-to-scale generalisation facilities,
  - state-of-the-art electronic maps and atlases,
  - user-friendly software providing even more customisable map presentations for the cartographically naive (e.g. with hyperlinks to pictures, movies and text).
- Standards: especially data quality and transfer standards related to growth of the Internet. The costs of hardware and software have dropped dramatically; today 85% goes on data.
-
- Virtual reality (virtual worlds): with increasingly detailed spatial databases and appropriate software and interactive devices, real physical space may to become increasingly 'irrelevant' and remote for some users. This will certainly introduce questions about the misuse of data or decision-making in artificial worlds.

- Working in teams: While cartography will be different in 2020 AD, the changes will be towards greater stature and identity for the subject within geospatial science and the scientific community in general. This will grow from a richer foundation of theory and practical experience in the areas of map and system design as well as in the techniques and strategies of map use. New, semi-automatic, GIS will depend much more heavily on enhanced intelligence cartographic display interfaces to satisfy regular professional users who will continue to demand high quality (if perhaps somewhat standardised) products as part of the decision-support facility. However total automation need not be (indeed cannot be) the ultimate goal for cartography. In the field of architecture and building, today, for instance, many processes and products may similarly have been standardised to reduce costs and increase speed of completion. But when it comes to special commissions for buildings, small or large, the full scope of the individual architect's imagination and creativity is required to provide innovative solutions to unique problems. While this analogy is not perfect, similar circumstances can apply in mapping when expert cartographic designers are required to help resolve specific problems relating to data characteristics for special needs, representation-communication objectives and customer profiles. Ideally, in both situations (semi-automated and customised), and dependent on the size of the project, cartographic advisors would work in teams with other geo-information specialists, in data collection, assessment of local circumstances and data processing. Naturally these cartographers would also have some knowledge of these other fields especially where they have a bearing on data quality.

Geospatial Sciences and the Future

I. A more general kind of spatial science?

Looking towards the broader field (referred to variously as Geomatics, Geoinformatics, Geospatial Science...) we see similarities between the associated technological trends and those listed under 'mapping'. But there will also be, for example, more digital methodology, more remote sensing with higher resolution, and an increasing shift from data to knowledge. Currently there appear to be a number of separate international organisations concerned with cartography-related fields such as geodesy, surveying, photogrammetry and remote sensing. There seems to be a gradual and inevitable process of convergence. The component sciences are coming closer together and

this is closely related to (if not the direct consequence of) a simultaneous merging of component technologies. If this convergence continues, along with increasing integration of technology and methodology, a more general kind of spatial science may emerge in due course.

There may be other key strategic aspects which can support the change:

- The emergence of a distinct science of spatial information, from an evolutionary background period of studies which may have seemed more technology-based. This will require a total review of spatial modelling and representation. Although it exists in other fields, a commonly-agreed theory of knowledge structure and representation has not yet emerged for geospatial science. When it has, the field will become more interdisciplinary in nature.
- Interdisciplinarity and multidisciplinarity. Tomorrow's spatially related problems cannot be solved without these two approaches being facilitated through the employment of spatial information systems.
- Inter-operability. With all their technological, organisational and even political aspects, the following will depend on increasing interoperability :
  - Spatial data infrastructures,
  - Systems and people,
  - Legal and pricing factors,
  - Maps, to achieve and maintain seamless, scaleless (i.e. with generalisation), multi-scale and multi-temporal spatial databases.
- Technology transfer. This must be achieved in various directions, such as :
  - Downscaling of high-technology for everyday use,
  - Transfer towards developing countries.
- Education
  - of spatial information system experts
  - to bridge the gap between experts and others
  - in developing countries

II. The application of geospatial science to general societal needs.

Naturally all this accumulating knowledge is already being applied but perhaps too often used as narrow examples of single techniques or technologies. There is an ever-growing need for unique and more broadly-based practical geospatial solutions to many world-wide social, environmental and economic problems, the ultimate challenge being to balance the development of natural resources against the maintenance of optimal environments. This will require rethinking the approaches to development, more globalisation, growing economic interdependence and social justice, equality and sustainable development. There is no doubt that exploration of these problems will require reliable geoinformation and the tools for its management, analysis and display as discussed in this paper and this will be enhanced by growing integration between sister organisations with common interests in spatial aspects of the environment.

Conclusion

The world is changing through the forces of nature and the actions of humankind. The responsibility of science is to promote the good and control, if not stop, changes which are bad. Although geospatial scientists need not be directly involved in solving all the world's problems, their responsibilities in the fields of collection, manipulation, analysis and display of spatially-related data is self-evident. Many geospatial science organisations have grown from a need to develop and apply appropriate technologies within one field (perhaps within specific

environments). Some such groups have a sharper focus than others whose remits may have become extended through the evolution of their subject. However the common core is still reliable spatial data, well established, clearly standardised and referenced and easy to store, access and transfer. This data will be manipulated, analysed, changed and viewed in various ways in the process of supporting a wide variety of tasks, from simple presentation to complex problem-solving. This relates to a number of disciplines. Cartography (analogue and digital), however, is, to a greater or lesser degree, present in them all. Even after a simple tacheometric survey, a map is produced, and maps or map-like objects are created at various stages in photogrammetry, remote sensing, GIS-supported studies, etc.

This all-pervading presence of maps relates back to the opening theme, that to many map users the field and scope of cartography may be 'invisible'. The truth is that maps are not just the visible (or digital) end-points of a survey or GIS-based operation. They are also tools for spatial modelling, data exploration, analysis and representation and can be used at almost every stage of an investigation. Indeed cognitive maps are frequently used to review spatial problems even before the involvement of hard data ! Cartography and cartographers therefore not only add value to geodetic frameworks, reference systems and spatial data but they also make them eminently more accessible to the using public at every level.

As explained above, cartography is evolving, both in theory and practice, but is currently at a critical stage in its development. Never before has the potential value of maps (in all their forms) been so great : in helping structure conceptual models of reality, for the active visual exploration and analysis of problems and for the representation and sharing of knowledge and solutions. But all this is happening on a still insecure foundation of mapping theory at the data modelling and combination stage, for product design and for human usage of the facilities. The urgency to develop these fields is paramount. It is thus essential to have an international dedicated body, such as the ICA, which can promote and co-ordinate developments in both theory and technology and seek their successful application to the good of humankind.

Increased awareness of the nature and potential of new cartographic tools and geo-spatial databases will lead to an expansion and re-definition of the scope of cartography with a parallel development of cartographic theory for electronic (digital) mapping. The recent emphasis on Geographic (scientific) Visualisation (and the incorporation of multimedia) as a new way of defining map use in exploratory research is another reason to maintain a uniquely identifiable body of experts in this field. Transition from technology-based to true science (spatial information science) - from the currently mechanistic, technology-driven studies of space to a deeper understanding of the basics of models and other representations of space is an added reason to do so.

Idealistically a Geospatial Scientific team will involve, directly or indirectly, all the relevant experts (remote sensing, geodetic, cartographic, etc.). Some may be present 'in person', especially professional users (e.g. resource managers), tussling with the problem in hand, others, e.g. cartographers, may have contributed an enhanced-intelligence help module and GVIS/Mapping package to link with a GIS. This would permit the visual exploration of data and the display of intermediate and final solutions. What is not in doubt is the increasing need in the future for co-ordinated interdisciplinary activities with each branch of the science being at least aware of and having respect for the scope and unique characteristics of the others.

The ICA vision of the future of cartography therefore is to have a firm theoretical basis for knowledge representation and the modelling of reality, a fuller appreciation of map reading and map use strategies (especially in the more animated and interactive image environments of today), to become established as a subject, through the application of GVIS, as an essential tool for data exploration and analysis and and not just data representstion, but, nevertheless to retain and develop its status as the most powerful method of spatial data representation. Cartography will be applied within geospatial science as an essential component and of equal value to the facilities of sister subject fields. Only through access to a full array of geospatial science procedures will world problems be successfully addressed and resolved.

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THE AMERICAS
New York, 2-6 June 1997
Item 5 (a) of the provisional agenda*

REVIEW OF THE LATEST TECHNOLOGY IN CARTOGRAPHIC DATA ACQUISITION, MANIPULATION, STORAGE AND PRESENTATION, WITH SPECIAL EMPHASIS ON POTENTIAL APPLICATIONS IN DEVELOPING COUNTRIES: AUTOMATED MAPPING PROJECTS: DEVELOPMENT AND APPLICATION OF DIGITAL CARTOGRAPHIC DATABASES, INCLUDING DIGITAL TERRAIN MODELLING

Cartography at the Brazilian Institute of Geography and Statistics (IBGE)

Paper submitted by Brazil

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ABSTRACT

The Brazilian Institute of Geography and Statistics (IBGE) , a governamental institution of the Repuplic Presidency Planning Ministry, through the Cartographic Department of Earth Sciencie Management, is the integrant Agency of the National Cartographic System, responsible for the National Mapping in Geographic scales (millionth international sheets (CIM) - 1:1.000.000 ; Brazil series sheets - 1:2.500.000, 1:500.000, 1:10.000.000; Regional sheets, States sheets and Atlas) and topographic scales (1:250.000, 1:100.000, 1:50.000 and 1:25.000).

The major objective in changing the approach of cartographic data is the formation of a new cartographic database (Cartographic Database), so that it can be the georeferences database support to emergent Geographic Information Systems, as well as helping the establishment of cartographic positives through computerized ways.

This paper will show you how the Cartographic Department of the IBGE has planned and has been planning this new way of cartographic data production as well as, lauching the products available in digital media.

I) INTRODUCTION

The **Brazilian Institute** of **Geography** and **Statistics**, was set up in 1934, through the necessity of linkage of some cartographic services and government statistics requirements. Nowadays, the **IBGE** is in charge of The National Statistics System (SEN) and The National Cartographic System (SCN) as well. Therefore, the IBGE focus its attention on data production. The two main areas are: **Statistics** and **Earth Science**.

In Brazil, the linkage of these two sciences at the same company, helps the IBGE to make up an overall portrait of the country and represents an easy and cheap way of data production.

In the development of the portrait of Brazil, the IBGE uses three basic languages : **Statistical**, **Geographic** and **Cartographic**.

The cartographic language is the beginning and the end of the process of production of Brazil's portrait. At first the company is responsible for the database construction in which the information is based and, at the end, is also responsible for geographic and statistical patterns.

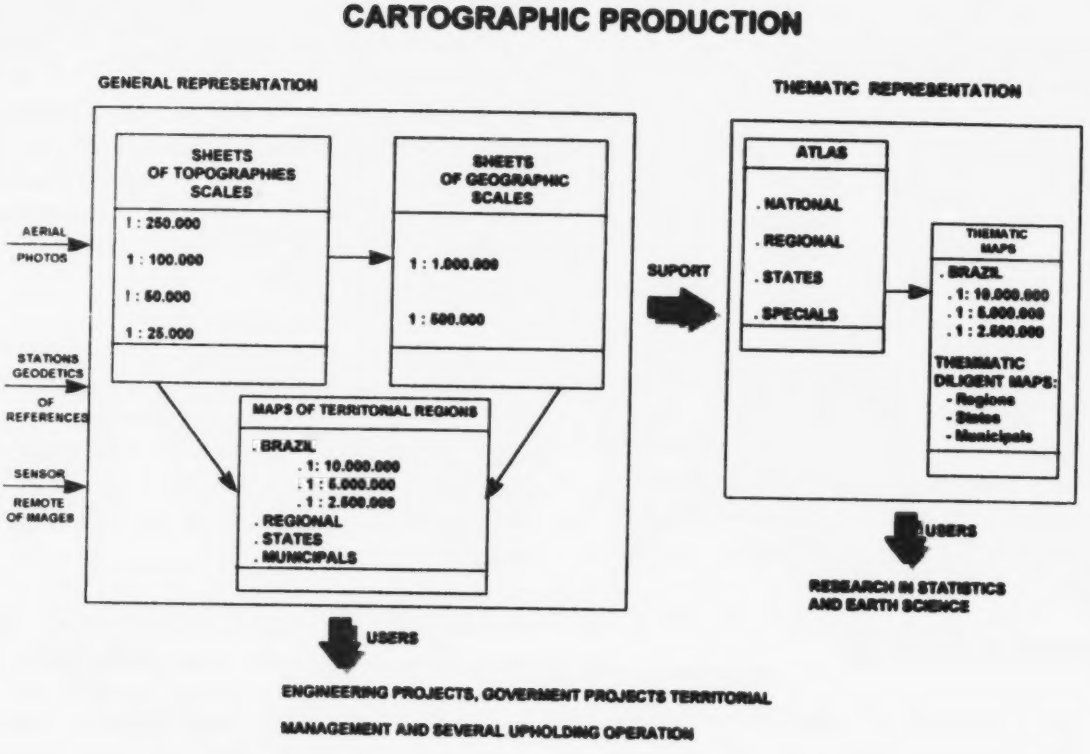
The IBGE is responsible for the systematic mapping, in geographic scales of the Brazilian territory and, co-responsible with The Geographic Service of Brazil Army Ministry, for systematic mapping in topographic scales.

The major areas are :

. The topographic mapping.
. The mapping of the territorial regions.
. The thematic mapping.

II) THE TOPOGRAPHIC MAPPING :

The topographic mapping stands for the Brazilian territory, through systematic ways of general sheets,unceasing, homogeneous and articulated, organized in agreement with the goverment priorities.



The major created products are :

. International Sheets of 1:1.000.000 scale.
. Topographics sheets in the following scales:

scale	methods
1:1.000.000	compilation
1:250.000	stereocompilation and compilation
1:100.000	stereocompilation
1:50.000	stereocompilation
1:25.000	stereocompilation

The position of the sistematic mapping of the Brazilian territory :

scale	total	% mapping
1:25.000	492	1,01
1:50.000	1647	13,9
1:100.000	2289	75,39
1:250.000	444	80,72
1:500.000	68	36,9
1:1.000.000	46	100,0

III) THE MAPPING OF THE TERRITORY REGIONS :

To depart from the topographic mapping it represents the Brazilian territories through maps specifically for each region of the country.

The created products are:

. The map of Brazil (The geographic scale - 1:2.500.000, 1:5.000.000, 1:10.000.000 and low scales)

. The Regional Maps (geographic scales).

. The Provincies Maps (geographic scales).

IV) CARTOGRAPHY DATABASE (M.T.D) AT THE IBGE:

At present the growing volume, diversity and the volatility of relevant information for the development in all sectors of the Brazilian society has determined that all companies involved in the establishement of policies and strategic planning of the systematic use of the natural country's resources, making use of instruments, methodologies and technologies which allow the analsys of integrated information and georeferencies.

In this manner we have noticed the crescent embodiment of technology of the geographic information system - GIS, for the production and diffusion of the information in several levels of the government and private enterprises.

The spatial components of the GIS system are the digital cartographic sheets in several scales and it becames urgent the transformation of the cartographic documents into digital database, together with descriptives information, will support several geographic analisys.

In this conversion we have to take into account the requirements, not used beforehand in drawings or in CAD's systems as well as the connection of network (hydrographic, roads, transmission and others) and the adjacensy and closing of polygonal elements. Through this prism the transposition cannot summarize the migration of the cartographic data digital enviroments, but also its topological structuture to facilitate the performance of some analisys.

In paralell with some projects still in assembly conventional production, the Cartographic Department acts creating basic conditions to convert the major sheets series and printed maps produced by the IBGE to digital cartographic database structured with topology requirements. This process started in 1990 with the World Bank approval of system datails to be acquired.

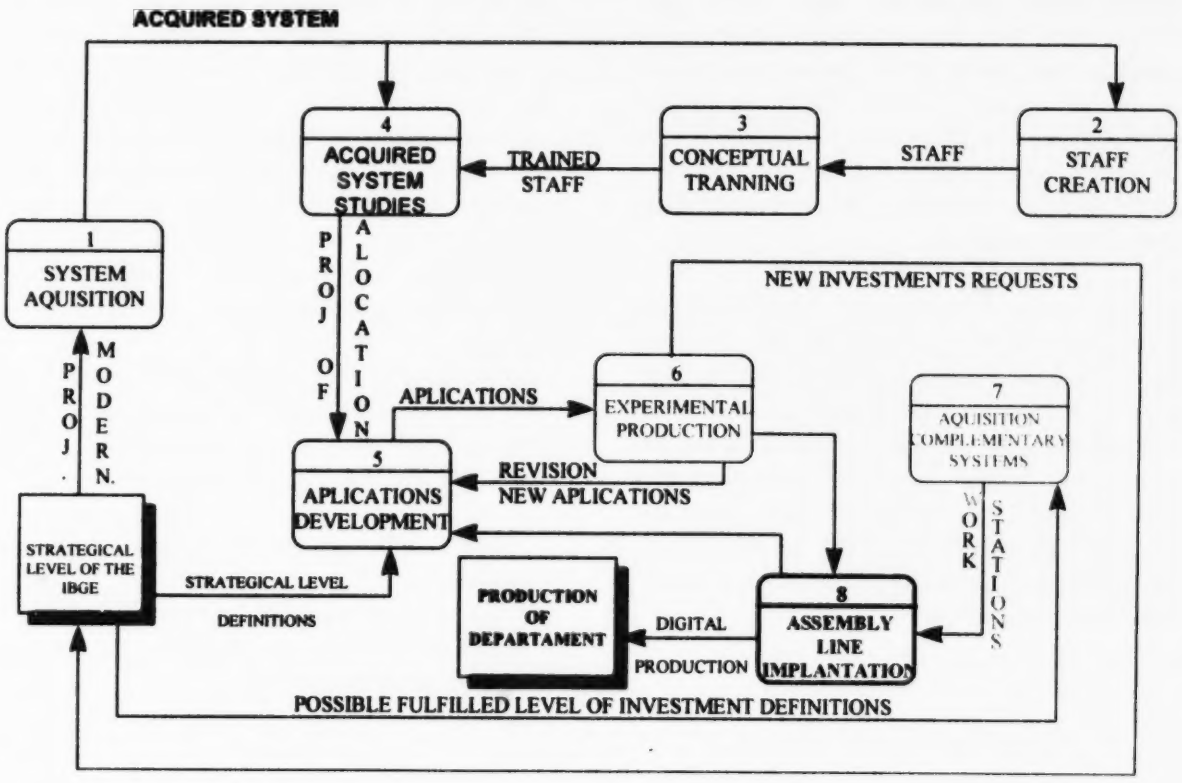
The development diagram of cartographic computerized was expanded as foreseen. Nowadays the project is in fase number eight of development diagram and the following steps are in the production area : Database Acquisition System by digital photogrametric stereocompilation; Structure and Database Management. We have started the pilot plant , in Cartographic updating with satellite images and radar images aerial.

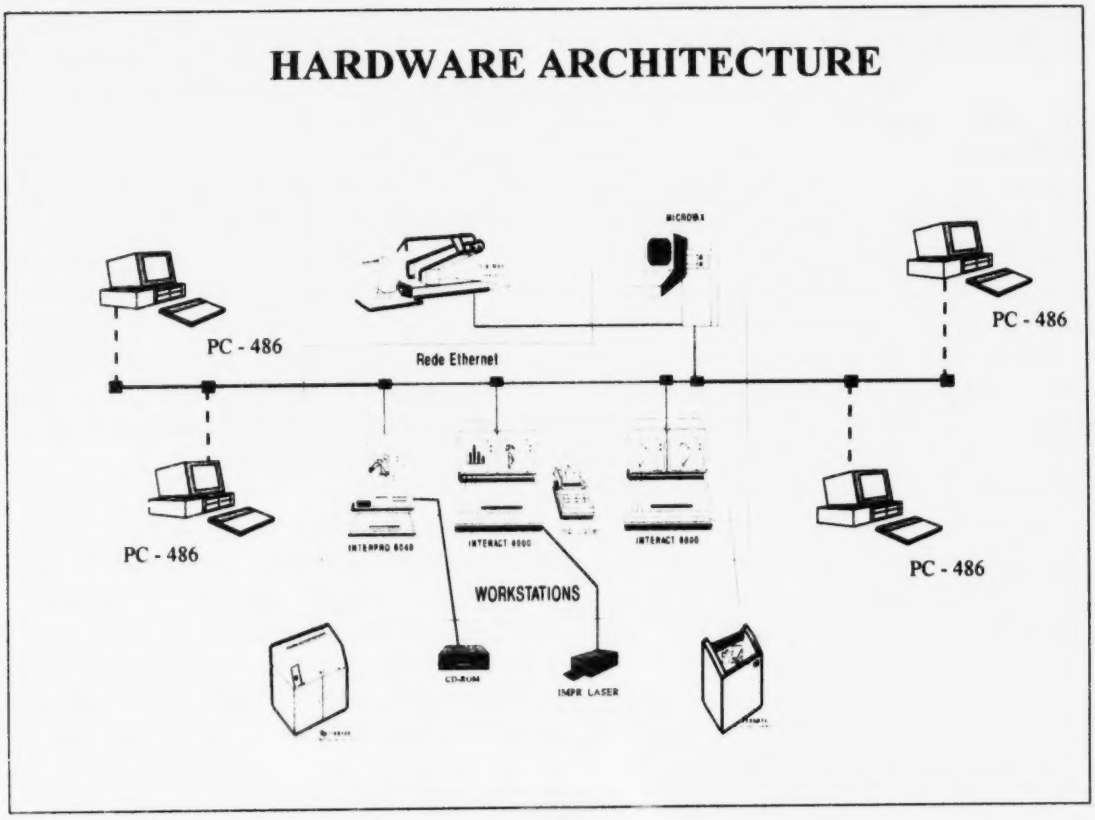
Throughout 1993 we had proceeded the adaptation of methodologies of some steps of the digital cartographic production through some projects of experimental production in the following areas: digital photogrametric stereocompilation, "digitalization" of positives by scanner; structured management and validation of MTD (Database cartographic); consolidation of the digital Municipal boundaries and automatic generation of cartographic positives.

The technological resources incorporated in the computerized project, formed this inicial step toward the modern cartographic. The assembly line was the following:

. Digital photogrametric stereocompilation system.
. Automatic digitalization system.
. Image Processing update system.
. Maps publishing system.

DIAGRAM OF DEVELOPMENT

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V) CARTOGRAPHY COMPUTERIZED PROJECT

This cartographic database has been building from conversion of printed sheets, manual digitalization and stereocompilation, and will be the database information which describes the topographic reality of the country speaking of natural caracteristics as well as cultural.

The double purpose of this database is to grant the two principal as folowing:

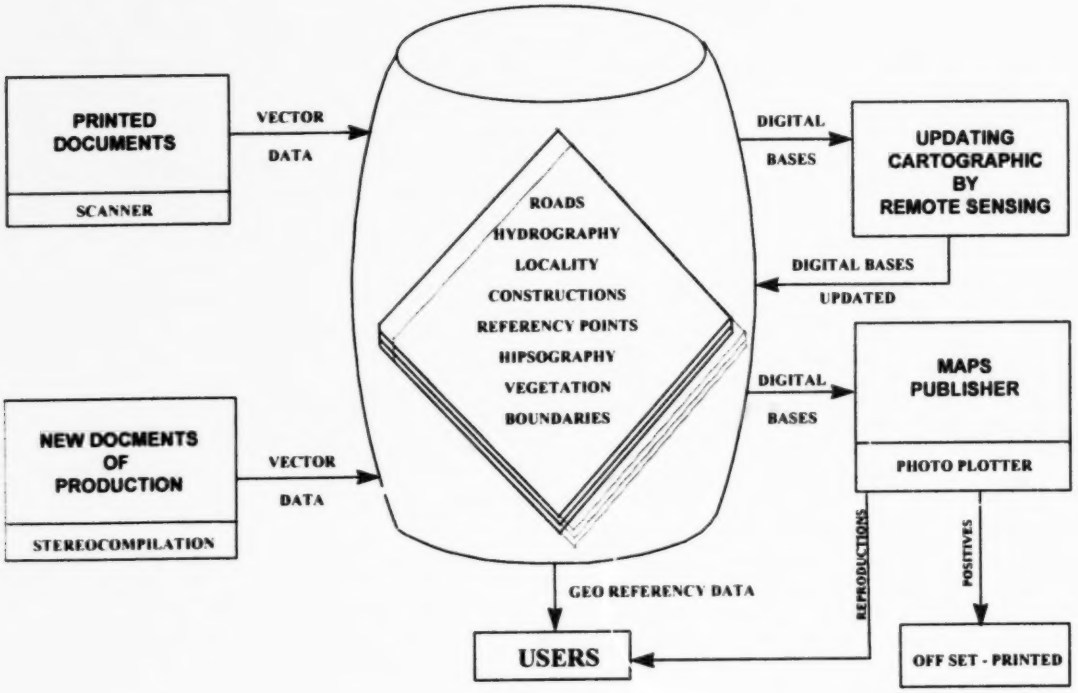
1) Scattering of digital cartoghaphic data for users, in order to serve as georeferences basis in Geographic Informatiom System.

2) Generation of updated cartographic products printed from the structure in database with guaranteed topology requirements.

Considering the activities at the IBGE that new approach will allow the integration of several informational classes, mainly information about natural resorces and social-economic, through geographic georeferency, embodied by national topographic reality acquired from the conversion of the sheets of the topographic mapping to digital database.

In brief, the internal projects which the cartographic database intends to support are: The national topographic mapping, municipal mapping which is the basis to collect data to census, prevision of harvest agriculture, Atlas production, Survey projects and mapping natural resources.

DATA BASE CARTOGRAPHIC



The cartographic database is structured into the next information categories:

1 - Hipsography
2 - Bounderies
3 - Control Points
4 - Hidrography
5 - Vegetation
6 - Locality
7 - Roads and Railroads
8 - Constructions

The objective of the first computerizing phase was how the development of some methodologies, normatizations and procedures to digital cartographic production and database shaping was obtained.

Throughout all these years of study and development it was possible to measure the term and expenses to execute some steps of the digital production, as well as revalidation of some specification, at first definited, in order to rush the development and the implantation of digital tecniques in assembly line. The phases of data publication in **raster format** and **data raster vectorization**, we migrated to PC's platforms linked in net.

VI) DESCRIPTION OF SOME PRODUCTS AVAILABLE IN DATABASE

1) The Digital State Map :

From the conversion of positives of the Millionth International sheet - (CIM), whose ending is forecast for the first term of 1997, new publications of state maps will be created, by compilation in digital environment of the states whose representation uses as supply the proportion 1:1.000.00.

2) The Digital Municipal Map :

The generation of some municipal maps in digital environment, depends on the topographic mapping conversion, in which the cooperation and articulation of governamental instituitions is primordial. The municipal map is the cartographic reference to census operational basis, and above them we have planned the census sectors to economic and social survey.

3) The Digital Photogrametric Stereocompilation:

Since 1993 the Carthographic Department is capable of creating in digital enviroment, by the photogrametric process, the topographic mapping sheets.

The machinery for the cartographic production is made up with six Wild B8 equipment and four KernPG2 equipment. Only the Wild B8 equipment repowered, and we are waiting for the PG2 repowering.

4) The Digital Municipal Boundary:

The Digital Municipal Boundary is made up of by the boundaries of politic-administrative division and were digitalized from the topographic mapping sheets. The municipal chart untill 1993 had 4974 provincies. From 1993 to 1997 were created more than 1600 provincies, and until may 1997 the municipal net must be updated. Availabe in CD-ROM in dxf, dgn and e00 format.

5) The Brazilian-Politic Map 1:5.000.000 scale:

From the digitalization of the cartographic positives of the Brazilian-politic map, is available in digital way. It is based on eight information categories of

cartographic database (MTD). Vehicled in CD-ROM dxf, dgn e e00 format.

6) The Environmental Diagnosis of the Legal Amazon:

The diagnosis is a Federal Government Program part of a general program called Ecological and Economic Zone. The program has got the main target to show a portrait of the area (covering the whole area of the Legal Amazon), speaking of the environment and the social-economic aspects and establish some planning procedures in macro scale.

The principal idea is to encourage the states to go on doing their own zone procedure and establisment of proper laws in consonence with the purpose in regional diagnosis. All information used in the diagnosis generation were converted to estructured digital ways for the use in Geographic Information System and has heralded for all prospective users.

The covered items are in 1:2.500.000 scale once the regional overspread the following items: cartographic base, geology, geomorphology, pedology, vegetation, the use of land, socio-economic aspects, antropism and preservation units (natural parks, native lands etc.) and hydrology.

7) The Brazilian Net of Continuous Monitoring (RBMC):

The IBGE launched the Brazilian Net of Continuous Monitoring and since may 1997 is available for users. There are nine GPS stations working twenty-four hours per day covering all country processing data.
The standard user will be able to connect the system in order get better data, accuracy, in terms of notes, saving money or time and cutting expenses.

VII) FINAL DISCUSSION:

The conversion of all mapping to digital environment is very expensive and the performance time is middle-term to long-term, and the conception and precision aquisition of the data are important factors which will define the fulfillment to Geographic Information System.

The cartographic bases at the IBGE was estructured to be used as spatial database in GIS.
To preserve the uniformity and quality of cartogaphy database at the IBGE (MTD), is necessary the development of applications to implementation the validation cartographic bases produced in others instituitions. The standartization and manners to interchange of cartography database some questions among others which need more discussions among productors and database cartographic users.
Nowadays this discuss has already started in The National Cartography Commission (CONCAR), this entity was brought back in 1997 and meets most of the instituitions which work with cartography in Brazil.
The conversion to digital environment and mapping updating, requests some efforts to cooperation and articulation betwen the IBGE and associates instituitions as well as expressive investments as much as in data production and cartographic basis interchange.
Nowadays we believe that projects like census 2000 year, The Vigilancy Amazon System (SIVAM Project) and the question of land reform, will lever in short-term updating of the cartography in Brazil.
At present there is at the IBGE a high consciousness to allocate new resources in projects of modernization and increase the cartographic digital production. About U$ 8,500.000.00 was allocated in 1997 and hope by 1998 the IBGE only will produce digital cartographic data in all its assembly lines.

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Item 5 (a) of the provisional agenda*

REVIEW OF THE LATEST TECHNOLOGY IN CARTOGRAPHIC DATA ACQUISITION, MANIPULATION, STORAGE AND PRESENTATION, WITH SPECIAL EMPHASIS ON POTENTIAL APPLICATIONS IN DEVELOPING COUNTRIES: AUTOMATED MAPPING PROJECTS: DEVELOPMENT AND APPLICATION OF DIGITAL CARTOGRAPHIC DATABASES, INCLUDING DIGITAL TERRAIN MODELLING

Uniform, reliable map data sets for the Baltic Sea Region (MapBSR Project)

Paper submitted by Finland**

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Abstract

The purpose of the MapBSR project is to provide basic map data sets for the Baltic Sea drainage area and the countries in its sphere of influence in the nominal scale of 1:1 million. The MapBSR Project will provide the first uniform, reliable map data sets for the Baltic Sea drainage area and the countries within its sphere of influence. The users for the database will include natural resource management, environmental impact assessment, administration, transnational planning, research and map production.

The project's coordinator is the National Land Survey of Finland. The participants of the project are the National Mapping Agencies of the 14 countries around the Baltic Sea (the Russian Federation, Estonia, Latvia, Lithuania, Belarus, Ukraine, Poland, the Czech Republic, the Slovak Republic, Germany, Denmark, Norway, Sweden and Finland).

Uniform, reliable map data sets for the Baltic Sea Region

The demands for geographic information are growing. Important areas where GI technology is providing new opportunities include critical trans-national areas, such as the Baltic Sea region, which require different kinds of information to be brought together.

The Vision and Strategies around the Baltic Sea (VASAB) 2010 project was initiated in 1992 by the Baltic region Ministers of Physical Planning. At the conference held in Karlskrona, Sweden, it was stated that a coordinated map data system should be created covering the entire Baltic Sea Region with basic geographic information. Since 1992 two international seminars have been arranged (Sweden 1994 and Finland 1995), which further identified the need for such a cartographic database.

The purpose of the MapBSR project is to provide basic map data sets for the Baltic Sea drainage area and the countries in its sphere of influence in the nominal scale of 1:1 million. The elements included in the database are boundaries, hydrography, transport, settlements, geographical names, elevation, nature and land use. When completed, the database will form a base map for geographic information systems (GIS), in which any kind of data item can be located and represented, as long its coordinates are known. Different kinds of thematic information can therefore be added to the database, such as statistics on population density or data on water quality.

The National Mapping Agencies of each of the participating countries will produce the map elements for the areas of their respective countries. These will then be combined into one cartographic database.

MapBSR Project covers the Baltic Sea drainage area and the countries in its sphere of influence.

- Countries as whole:
  Finland, Sweden, Norway, Denmark, Poland, Latvia, Lithuania, Estonia, Belarus, Ukraine and the Slovak Republic.
- The administrative units that intersect the Baltic Sea drainage area in:
  The Russian Federation:
  Murmansk, Karelia, Leningrad, Arkhangel'sk, Pskov, Novgorod, Tver', Smolensk, Kaliningrad and Vologda oblasts
  Germany :
  Schleswig-Holstein, Mecklenburg-Vorpommern, Hamburg, Berlin, Brandenburg and Regierungsbezirk Dresden in Sachsen
  The Czech Republic:
  North-bohemian, East-bohemian and North-moravian regions

MapBSR data will be produced by groups of themes so that ready parts can be published and distributed when ready. The first two themes, which are under construction at the moment, are hydrography and boundaries.

Timetable:

Hydrography	under construction (1997)
Boundaries	under construction (1997)
Transport	1998
Settlements	1998
Geographical names	1998
Elevation	1999
Nature	1999
Land use	1999

National databases will be prepared to ARC/INFO format as seamless coverages and updating will be done on a regular basis when the database is ready. Copyright of the database is owned by the participating National Mapping Agencies.